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PATENT SPECIFICATION

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(54) MOULDING OF POLYMERIC MATERIAL

(71) We, INSTITUTE po
 METALOZNANIE i TECHNOLOGIA na
 METALITE, of 53, Chapaev Str., Sofia 13,
 Bulgaria, a Research Institute organized
 under the Laws of Bulgaria, do hereby
 declare the invention, for which we pray
 that a patent may be granted to us, and the
 method by which it is to be performed, to be
 particularly described in and by the
 following statement:—

This invention relates to a method of
 producing an article having a smooth non-
 cellular skin and a cellular core and also
 relates to an injection nozzle for use in
 carrying out the method.

According to one aspect of the present
 invention there is provided a method of
 producing an article having a smooth, non-
 cellular skin and a cellular core by injection
 moulding of a polymer material containing
 a blowing agent, the method comprising the
 steps of:

(a) injecting a first batch of the material
 through a nozzle into a mould at a
 temperature below that at which foaming
 takes place, and

(b) injecting a second batch of the
 material through the nozzle into the mould
 at a temperature above that at which
 foaming takes place,
 whereby the first batch forms the skin and
 the second batch forms the core of the
 article.

According to another aspect of the
 present invention there is provided an
 injection nozzle for injecting a polymer
 material into a mould, the nozzle including
 a body having a duct for conveying the
 material to be injected, which duct contains
 an elongate electric heating element which
 is disposed coaxially with the duct.

The present invention also provides
 injection moulding apparatus including an
 injection nozzle in accordance with the said
 second aspect.

The present invention may be carried
 into practice in a number of ways, but one
 specific embodiment will now be described,
 by way of example only, with reference to
 the accompanying drawings, in which:

Figure 1 is a sectional view through an
 injection nozzle, and

Figures 2 to 5 show sectional views
 through a mould at different stages during
 an injection moulding process.

Figure 1 shows an injection nozzle
 including a body consisting of two
 electrically conductive components 1 and 5,
 which are connected together by a nut 4
 and are electrically insulated from each
 other by two insulating rings 3. The nozzle
 affords a through duct coaxial with which
 there is disposed an electric heating
 element 2. One end of this element 2 is
 welded to the component 1, while the other
 end is welded to the component 5. Current
 supply to the heating element can be
 switched on or off at a supply and control
 block 7 which is connected to a current
 source. The nozzle can be attached to the
 end of a plasticating and injection unit 6 of
 an injection moulding machine.

The moulding of an article, using the
 nozzle shown in Figure 1, will now be
 described with reference to Figures 2 to 5.

A polymer melt, containing a blowing
 agent, is heated to a temperature lower than
 that at which foaming takes place, i.e. lower
 than the decomposition temperature of the
 blowing agent, and a first batch 9, of
 unfoamed material, is injected into the
 mould cavity of a mould 8 (Figure 2). After
 the required quantity of material necessary
 for the formation of a smooth non-cellular
 skin has been introduced into the mould,
 the electric heating element 2 in the nozzle
 is switched on, thus abruptly increasing the
 temperature of the polymer melt which is
 flowing through the nozzle to a temperature
 above that at which foaming occurs, i.e.
 above the decomposition temperature of
 the blowing agent, and a second batch 10,
 this time of foamed material, is injected into
 the mould (Figures 3 and 4). Heating
 continues until enough foamed material has
 been introduced into the mould to form the
 cellular core. Towards the end of the filling
 process the electric heating element 2 is
 switched off in order to reduce the
 temperature of the material below the

decomposition temperature of the blowing agent, and a third batch 11, again of unfoamed material is injected into the mould, so as to obtain a non-cellular skin in the area of the sprue (Figure 5). The penetration of the material into all parts of the mould cavity takes place under the action of the pressure of the decomposition gas products, formed during the foaming of the material of the core.

WHAT WE CLAIM IS:—

1. A method of producing an article having a smooth, non-cellular skin and a cellular core by injection moulding of a polymer material containing a blowing agent, the method comprising the steps of:

(a) injecting a first batch of the material through a nozzle into a mould at a temperature below that at which foaming takes place, and

(b) injecting a second batch of the material through the nozzle into the mould at a temperature above that at which foaming takes place,

whereby the first batch forms the skin and the second batch forms the core of the article.

2. A method as claimed in claim 1, including the further step, after injecting the second batch, of injecting a third batch of the material at a temperature below that at which foaming takes place to afford a non-cellular skin portion in the region where the material is introduced into the mould.

3. An injection nozzle for injecting a polymer material into a mould, the nozzle

including a body having a duct for conveying the material to be injected, which duct contains an elongate electric heating element which is disposed coaxially with the duct.

4. An injection nozzle as claimed in claim 3, in which the body comprises two electrically conductive components, each end of the heating element being connected to one respective component, the components being otherwise electrically insulated from each other, each component being provided with means for connecting it to a current source.

5. An injection nozzle substantially as specifically described herein with reference to the accompanying drawings.

6. Injection moulding apparatus including an injection nozzle as claimed in any one of claims 4 to 6.

7. A method of producing an article, the method being substantially as specifically described herein with reference to the accompanying drawings.

HASELTINE LAKE & CO.,
Chartered Patent Agents,
28 Southampton Buildings,
Chancery Lane,
London WC2A 1AT
— and —
Temple Gate House,
Temple Gate,
Bristol BS1 6PT.
— and —
9 Park Square,
Leeds LS1 2LH.

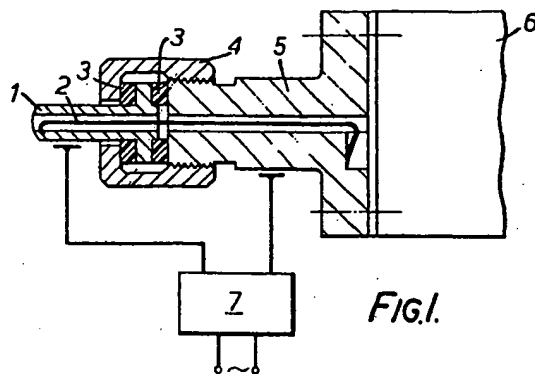


FIG. 1.

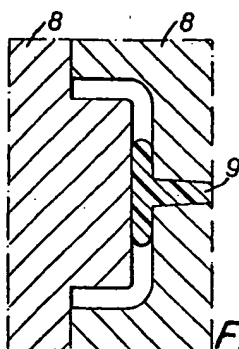


FIG. 2.

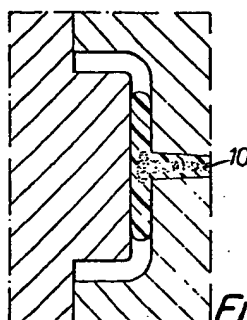


FIG. 3.

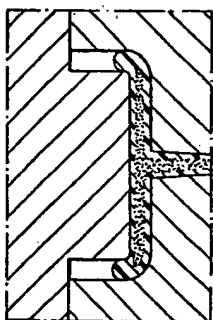


FIG. 4.

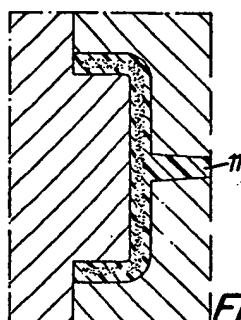


FIG. 5.